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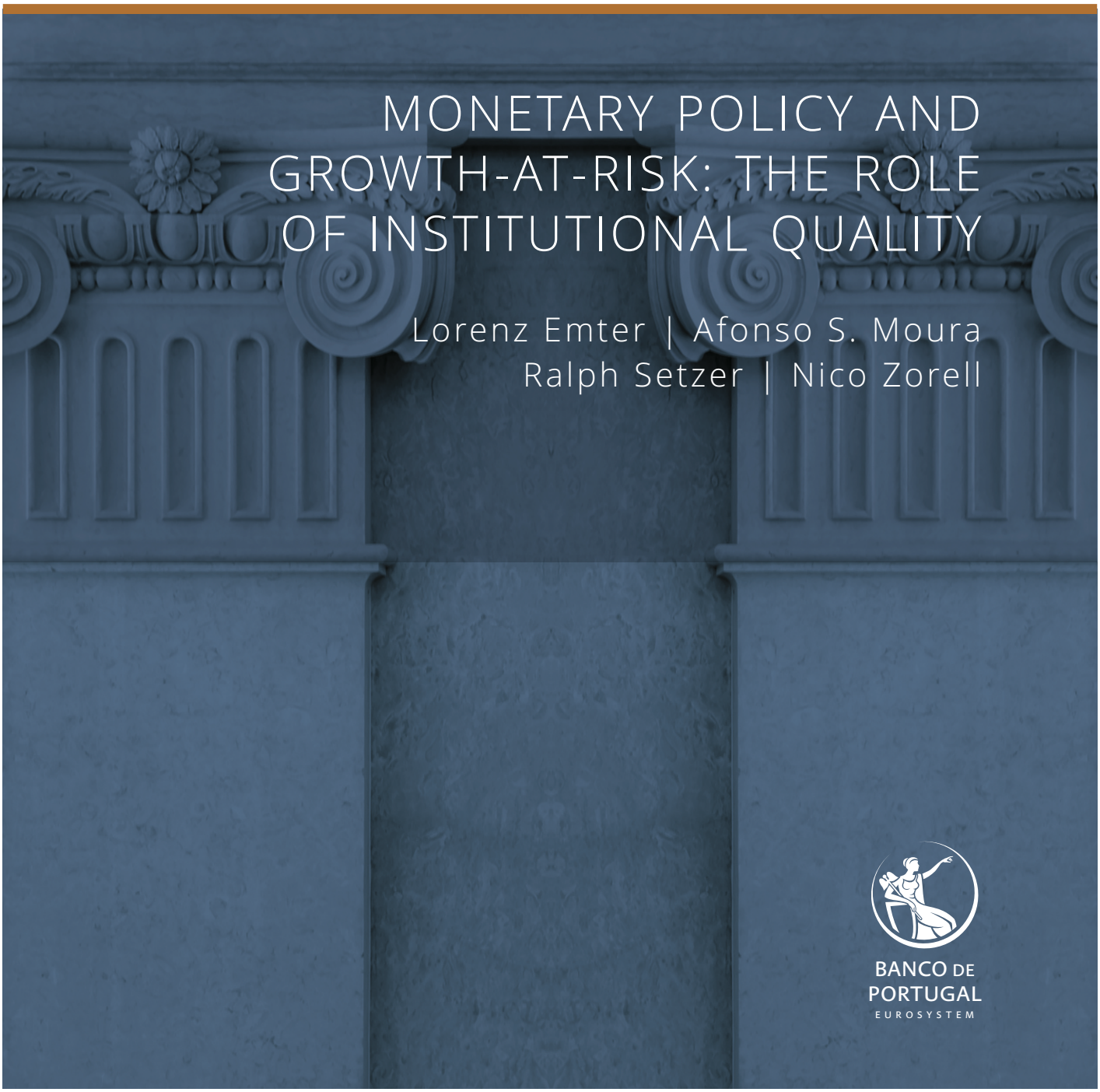

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OCTOBER 2024

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Monetary policy and growth-at-risk: the role of institutional quality

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Abstract
This paper analyses how country-specific institutional quality shapes the impact of monetary policy on downside risks to GDP growth in the euro area. Using identified high-frequency shocks in a growth-at-risk framework, we show that monetary policy has a higher impact on downside risks in the short term than in the medium term. However, this result for the euro area average hides significant heterogeneity across countries. In economies with weak institutional quality, medium-term growth risks increase substantially following contractionary monetary policy shocks. In contrast, these risks remain relatively stable in countries with high institutional quality. This suggests that improvements in institutional quality could significantly enhance euro area countries' economic resilience and support the smooth transmission of monetary policy.

JEL: C23, E52, F45, G28, O43

Keywords: Euro area, growth-at-risk, institutional quality, monetary policy transmission.

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1. Introduction

25 years after the introduction of the euro, the euro area countries are still heterogeneous in terms of economic structures. This is particularly evident in standard indicators of institutional quality, such as the World Bank's World Governance Indicators (WGI). While some euro area countries are close to the global frontier, others are lagging.

It is widely recognised that cross-country differences in institutions and other economic structures have important implications for the transmission of the ECB's monetary policy. In particular, structural heterogeneity can contribute to cross-country differences in the responses of output and inflation to monetary policy decisions (Barigozzi *et al.* 2014; Ciccarelli *et al.* 2013; Corsetti *et al.* 2022; Masuch *et al.* 2023; Slacalek *et al.* 2020).[1] For instance, economies with strong institutional quality are likely to be less dependent on short-term financial inflows from abroad and may therefore be less vulnerable to tightening financial conditions than countries with weaker institutional backgrounds. Such cross-country heterogeneity may contribute to real or nominal divergences, making it less likely that the common monetary policy is aligned with economic conditions in each individual euro area country.

In this paper, we explore if differences in institutional quality across euro area countries also matter for *tail risks* in the aftermath of monetary policy shocks. When policymakers consider the impact of monetary policy changes on future economic activity, they typically focus on the most likely scenario, i.e. the mean of the (conditional) distribution of future GDP growth. However, central banks also increasingly analyse the risks around the central projection in quantitative terms. Against this backdrop, our paper aims to shed light on the role of institutional factors in shaping downside risks to GDP growth in the aftermath of monetary policy shocks in a heterogeneous monetary union.

To capture downside risks to future GDP growth, we use the growth-at-risk (GaR) framework proposed by Adrian *et al.* (2019). In line with the literature (see, e.g., Figueres and Jarociński (2020) and Gächter *et al.* (2023)), we define GaR as the lowest decile of the distribution of predicted GDP growth, for a given time horizon, conditional on a set of current economic and financial conditions. Our GaR measure is derived from a panel quantile regression, using the estimator developed by Machado and Santos Silva (2019). The sample covers all 20 euro area countries over the period 1999Q1-2019Q4.

In a second step, we estimate the causal impact of monetary policy shocks on GaR following the method proposed by Loria *et al.* (2024).[2] Monetary policy

1. Taking a broader perspective, Sondermann (2018) shows that the output loss suffered by euro area countries with weaker economic structures in response to a common shock (not necessarily a monetary policy shock) is on average twice as large as the output loss of the best performers.

2. While the GaR literature typically does not identify the causal impact of structural shocks on GaR, Loria *et al.* (2024) show that contractionary US monetary policy shocks are among the

shocks are constructed based on high-frequency movements in asset prices around ECB policy announcements and cleaned from central bank information effects (Gürkaynak *et al.* (2005); Altavilla *et al.* (2019); Jarociński and Karadi (2020)). We use the World Bank's WGI data (Kaufmann and Kraay 2023) to split the sample into euro area countries with weaker and stronger institutional quality, respectively. This allows us to study differences in the impulse responses of GaR to monetary policy shocks between these two country groups.

We find that monetary policy has a higher impact on downside risks to GDP growth in the short term than in the medium term. However, this aggregate result hides significant heterogeneity across countries. In economies with weak institutional quality, medium-term growth risks increase substantially following contractionary monetary policy shocks. In contrast, these risks remain relatively stable in countries with high institutional quality. Interestingly, expansionary monetary policy shocks have a more symmetric impact than contractionary shocks, both across countries and quantiles of the conditional growth distribution.

Inspecting the transmission channels, we find that medium-term risks increase through the impact that monetary policy shocks have on variables capturing macro-financial vulnerabilities — and this channel is much more pronounced for countries with low institutional quality. Our main results are robust to (i) using different indicators capturing medium-term risks to GDP growth when estimating GaR, (ii) employing different indicators of institutional quality, (iii) accounting for cross-country differences in income levels and (iv) altering either the countries or the time period covered in the sample.

Our results have important policy implications. First, our empirical findings suggest that improving institutional quality can strengthen the economic resilience of euro area countries. Insofar, we complement existing studies that emphasise the role of bank capitalisation (Aikman *et al.* 2021), macroprudential measures or monetary policy instruments (Galán 2024) in steering GaR. Second, consistent with Masuch *et al.* (2023), our findings indicate that institutional convergence would support the smooth transmission of monetary policy by ensuring a more homogeneous response of the tail of the medium-term growth distribution to monetary policy tightening. This adds an important dimension to the discussion of financial stability considerations in the conduct of monetary policy (Bochmann *et al.* 2023).

The remainder of the paper is structured as follows. Section 2 outlines the methodology employed to estimate GaR and presents the resulting estimates. In Section 3, we compute impulse responses of the GaR measures to monetary policy shocks and explore the role of institutional quality in explaining the cross-country

structural shocks which disproportionately increase the risk of large downturns in the United States. Beutel *et al.* (2022) show that these shocks cause elevated downside risks to growth around the world. We follow this approach and establish causality between monetary policy shocks and GaR in the euro area.

heterogeneity in these impulse responses. Section 4 provides an overview of our robustness checks and Section 5 concludes.

2. Growth-at-risk and macro-financial vulnerabilities

We start our analysis by estimating GaR over different time horizons in a sample of euro area countries. This exercise illustrates the relative importance of different macro-financial variables for downside risks to growth, depending on the time horizon considered. We show that short-term GaR estimates for euro area countries are mostly associated with financial stress indicators, while medium-term risks to growth are not strongly correlated with current financial stress. Instead, only macro vulnerabilities matter for medium-term GaR. Our findings thus point to two different channels through which downside risks to GDP growth may materialise.

Building on our first-stage regression, Section 3 will explore the role of institutional quality in determining the response of GaR to monetary policy shocks. This two-step approach, as further explained in more detail in Section 3, enables us to focus on the effects of monetary policy that are transmitted via the conditioning variables in our first-stage regression. The methodology thereby allows us to identify the channels through which institutional factors shape the impact of monetary policy on GaR.

2.1. Methodology and data

Following Adrian *et al.* (2022), we estimate panel quantile regressions making use of local projection methods (Jordà 2005) so that we are able to estimate the conditional forecast of GDP growth both for the short term (defined as 4 quarters ahead) and the medium and longer term (8 and 12 quarters ahead, respectively). To estimate our model, we follow Machado and Santos Silva (2019) who derive an estimator of conditional quantiles from the combination of a location and a scale function, which is particularly useful in a panel setting with country fixed effects.[3]

Following Machado and Santos Silva (2019), the conditional predicted distribution of future GDP growth, for a given quantile of $\Delta y_{i,t+h}$, will be given by

$$q^h_{i,t,\tau} = \widehat{\boldsymbol{Q}_{\boldsymbol{\tau}}}(\Delta y_{i,t+h}|x_{i,t}) = \widehat{\alpha}_{i,\tau} + x_{i,t}\widehat{\delta}^h_\tau, \quad \tau \in (0,1). \tag{1}$$

In line with previous studies (see, e.g., Figueres and Jarociński (2020) and Gächter *et al.* (2023)), we consider the 10th percentile of predicted GDP growth

3. This approach allows the country fixed effects to vary across quantiles, such that $\alpha_{i,\tau} \equiv \alpha_i + \delta_i q(\tau)$. This contrasts, for example, with the method proposed by Canay (2011) which restricts country fixed effects to be invariant across quantiles.

to be our GaR measure. We define $\Delta y_{i,t+h}$ as the annualised average growth rate of GDP between quarters t and $t+h$: $\Delta y_{i,t+h} = \frac{log(Y_{i,t+h}) - log(Y_{i,t})}{h/4}$.[4]

The variables included in $x_{i,t}$ refer to financial stress indicators and macro-financial vulnerabilities, which have been shown to contain the most relevant information for medium-term GaR in the euro area (Lang *et al.* 2023). Financial stress is captured by the Country Level Index of Financial Stress (CLIFS), introduced by Duprey *et al.* (2017) based on Hollo *et al.* (2012). The CLIFS covers measures of stress in equity, bond and foreign exchange markets and takes co-movements in these market segments into account. Turning to indicators of macro-financial vulnerabilities, and as common in the GaR literature, we include a measure of excessive credit growth over the past two years. For that we rely on the BIS credit-to-GDP gap and calculate its cumulative deviation over the previous 8 quarters from its long-run trend. Both the CLIFS and the cumulative deviation from the trend of the credit-to-GDP gap are standardised by their country-specific standard deviations. We also include the growth rate in house prices over the past 8 quarters. In addition, to capture both public and external sector vulnerabilities we include the cyclically-adjusted budget balance and the seasonally-adjusted current account balance. Finally, the effect of overall current economic conditions on future downside risks is captured by including each country's GDP as a control variable, as is common in the literature.

Our sample covers all euro area countries in the time period from 1999Q1 to 2019Q4, although some variables are not available for the full observation period.[5] GDP growth rates are highly left-skewed during this period across countries as shown in Appendix A.1. Moreover, the unconditional lower percentiles of GDP growth show substantial heterogeneity across countries, much more so than the median of the unconditional GDP growth distribution (Figure A.2). In other words, some euro area countries appear to be more susceptible to weak growth outcomes than others. This is despite the fact that the euro area countries have been subject to a number of common shocks over this period. The cross-country heterogeneity thus suggests a role for country characteristics in exacerbating downside risks to growth.

2.2. GaR estimates

We start documenting our results by showing GaR estimates for different time horizons, together with the time series of their cross-country averages.[6] Figure 1 suggests that, in line with Adrian *et al.* (2019) and Adrian *et al.* (2022), the

4. For Ireland, we use the modified domestic demand indicator released by the national statistical authority. Compared to GDP, it is less affected by data distortions arising from the activities of multinational enterprises.

5. In Appendix A.4.2 we show that the coefficients do not significantly change if we extend the sample to include the COVID-19 period and the subsequent years.

6. See the footnote of Figure 1 for an explanation of how we obtain this series.

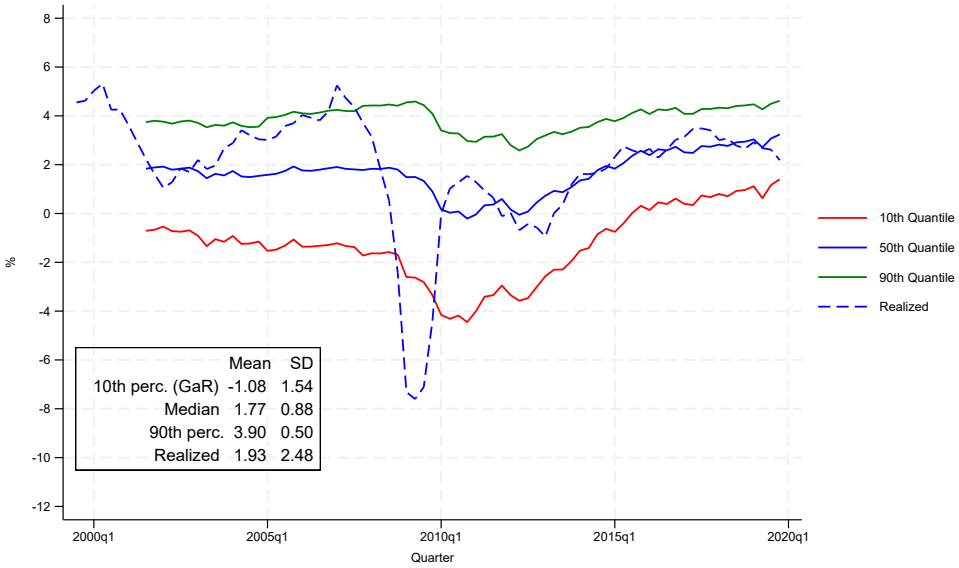


Figure 1: Predicted 10th percentile (GaR), median and 90th percentile of 8-quarter-ahead GDP growth and realised GDP growth

Notes: The predicted 8-quarter-ahead 10th percentile, median and 90th percentile of the annualised average growth rate of GDP are the cross-country averages of each country prediction (country specific predictions are obtained with the estimates of the panel model of equation 1). Once averaged by quarter, these series are shifted forward by 8 quarters such that the timing of the predicted growth rate and the realised one for a given quarter match.

predicted lower tail of the growth distribution is much more volatile than higher quantiles.[7] This means that downside risks to growth vary much more over time than upside risks. Our framework also appears to give an early prediction of the downturns and troughs of the global financial crisis in 2008. Although the 4-quarter-ahead GaR measure does a better job in this regard (see Appendix A.3), it is still interesting that the medium-term model can signal the increasing probability of a downturn around two years before it materialised.

Table 1 presents the estimated coefficients for the quantile regression, for different time horizons.[8] As noted above, our preferred measure of GaR is the

7. Since we are interested in cross-country heterogeneity and the role of institutional characteristics in the transmission of monetary policy, we focus on medium-term GaR. Figure 1 shows the cross-country average of 8-quarter-ahead GaR. In Appendix A.3 we show the same figure for other time horizons.

8. In appendix A.4 we show that these coefficients are very similar across a set of different specifications. Additionally, in appendix A.2 we show the coefficients for other quantiles of the distribution.

	h=4	h=8	h=12
CLIFS	-0.780***	-0.331	-0.176*
	(0.339)	(0.429)	(0.136)
GDP	0.318***	0.049	-0.004
	(0.158)	(0.195)	(0.054)
Credit-to-GDP Gap	-0.255	-0.525*	-0.435***
	(0.316)	(0.497)	(0.164)
House Prices	-0.040*	-0.039	-0.031***
	(0.035)	(0.050)	(0.015)
Budget Balance	0.441***	0.438**	0.314***
	(0.175)	(0.262)	(0.088)
Current Account	0.279***	0.228*	0.247***
	(0.094)	(0.142)	(0.048)
Observations	1179	1103	1027

Table 1. Quantile regression coefficients for different horizons of GaR

Notes: GaR refers to the 10th percentile of predicted GDP growth. Standard errors in parenthesis. Quantile regression with country fixed effects and controlling for the timing of euro adoption. Stars indicate significance at * $p<0.32$, ** $p<0.10$, *** $p<0.05$.

10th percentile of predicted GDP growth. There is a strong association between financial conditions and short-term risks to growth. A tightening of financial conditions, reflected in an increase in the CLIFS, is a significant predictor of large macroeconomic downturns over a four-quarter horizon. The information content of financial stress regarding risks to growth decreases over longer horizons (eight and twelve quarters) reflecting the fact that financial conditions may remain buoyant until shortly before risks materialise (IMF 2017). In contrast, incorporating information on the credit-to-GDP gap does not add explanatory power to GaR in the short term but helps to capture risks to growth over the medium- and longer-term (eight and twelve quarters). Strong rises in house prices, negative budget balances and negative current account balances also signal heightened tail risks to growth, especially over the longer term (or, at least, in similar magnitudes for shorter and longer horizons, as opposed to CLIFS). These findings on the term structure of GaR are in line with previous findings in the literature, such as Adrian *et al.* (2022) and in particular Lang *et al.* (2023) who show that only macro-financial vulnerability indicators reflecting credit and asset price imbalances contain information about medium-term GaR in the euro area. Therefore, we interpret this finding as evidence of two key channels behind short-term and medium-term GaR: a short-term channel connected with financial stress and a medium-term channel linked to macro-financial vulnerabilities.

It is also interesting to analyse the time variation in the contributions to downside risks from each explanatory variable. Figure 2 presents the contributions

to GaR for different horizons. Figure 2a illustrates that weak financial and economic conditions make the largest contribution to downside risks in the short-term. There is a significant contribution of CLIFS around the global financial crisis, as one would expect. However, Figure 2b shows that macroeconomic vulnerabilities weigh strongly on the prediction of GaR over longer horizons. In particular, weak public finances contributed strongly to the lower 10th percentile of conditional growth around the sovereign debt crisis. Figure 2c confirms the importance of macro-financial vulnerabilities for GaR in the longer term also over a horizon of 12 quarters. At the same time, the contribution of financial stress to longer-term risks to growth is negligible.

3. Impact of monetary policy shocks on growth-at-risk

This section looks at the impact of monetary policy shocks on GaR in a heterogeneous monetary union. More specifically, we analyse the extent to which cross-country differences in institutional quality affect the response of GaR to a monetary policy shock in the euro area. In doing so, we try to disentangle the relevance of financial conditions and macroeconomic vulnerabilities, respectively, as transmission channels. In addition, we explore possible non-linearities in these transmission channels depending on whether the monetary policy shock is contractionary or expansionary.

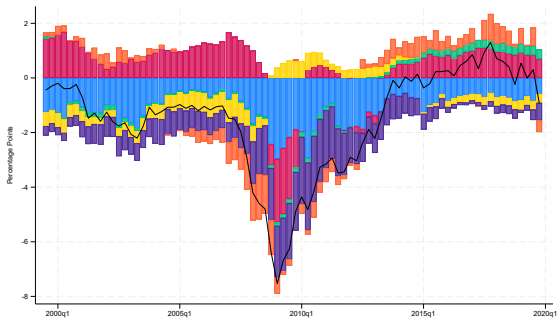
3.1. Methodology and data

Following Loria *et al.* (2024), we assess the response of the GaR values predicted in the first-stage regression (see Section 2.1) to monetary policy shocks. Defining $q^h_{i,t+s,\tau}$ as the s-quarter ahead values of the predicted τ^{th} quantile for a given horizon h of GaR, for country i, we use local projections (Jordà 2005) to recover the impulse response function (IRF) from the sequence of $\beta^h_{\tau,s}$, with $s \in (0, S)$. More specifically, we run the following sequence of linear regressions for our panel of countries:

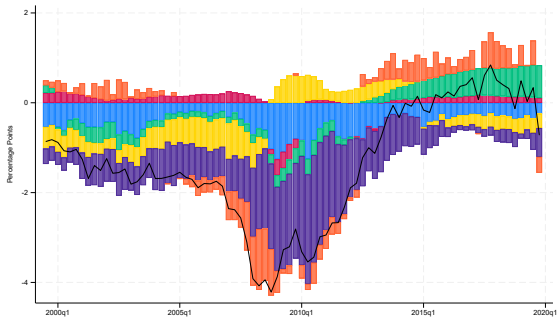
$$q^h_{i,t+s,\tau} = \gamma^h_{i,\tau} + \beta^h_{\tau,s} shock_t + \psi^h_{\tau,s}(L) z_t + u^h_{\tau,t+s} \tag{2}$$

where $shock_t$ is a monetary policy shock and $\psi^h_{\tau,s}(L) z_t$ is a lag polynomial of control variables that includes four lags of the shock, as well as four lags of GDP growth and euro area inflation. $\gamma^h_{i,\tau}$ are country-fixed effects that control for time-invariant country characteristics.

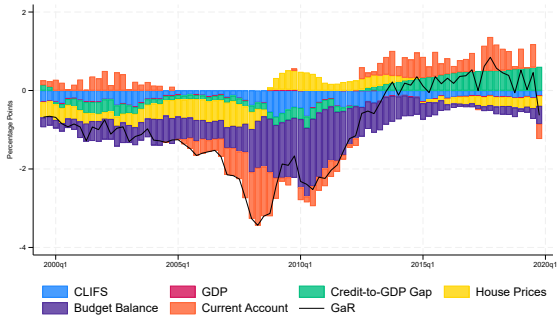
Importantly, we follow Loria *et al.* (2024) by using the 10th quantile of the conditional GDP growth distribution as a measure of macroeconomic risk. In other words, we are interested in the effects of a monetary policy shock on downside risks to GDP growth. We do not seek to examine how a monetary policy shock affects



(a) h=4



(b) h=8



(c) h=12

Figure 2: Average contributions to GaR forecast, h=4, h=8 and h=12 quarters ahead

Notes: GaR refers to the 10th percentile of predicted GDP growth. The predicted GaR measures plotted are the cross-country averages of the individual country predictions (that were obtained using model 1), net of the country fixed effect and the coefficient of the dummy for when the country adopted the euro.

actual output growth depending on the state of the economy. This distinction is important since Gonçalves *et al.* (2024) show that state-dependent local projections

only recover the conditional response to an infinitesimal shock but not the responses to larger shocks (unless the state is exogenous). Intuitively, a sufficiently large shock can push the economy from one quantile of the conditional distribution to another. However, for our purposes this is irrelevant because we use the 10th quantile as a risk metric and not as a description of the actual state of the economy

Furthermore, as Loria *et al.* (2024) emphasise, the IRFs recovered from equation 2 do not clarify if the response of a given quantile is unique or if other quantiles of the distribution show similar responses. In other words, it is not clear whether the entire conditional distribution of future GDP growth shifts in response to the monetary policy shock or whether the left skewness increases instead. Therefore, we also present the interquantile responses, defined as the difference between estimated quantiles ($q^h_{i,t+s,\tau_{10th}} - q^h_{i,t+s,\tau_{median}}$). They indicate to what extent the lower quantile (in our case, the 10th quantile) of the conditional distribution responds more than the median.

In essence, we follow a two-step approach in which we first estimate downside risks to growth (equation 1) before analysing the response of these risk measures to monetary policy shocks (equation 2). This approach has two key advantages compared to a one-step approach in which the monetary policy shock is directly included in the quantile regression. First, the two-step method allows us to focus on the effects of monetary policy that are transmitted via the conditioning variables in our first-stage regression, i.e. financial conditions and macroeconomic vulnerabilities. Second, the approach helps us distinguish two different time horizons: h, which indicates the horizon for the GaR measure in the first step, and s, which represents the response of this GaR measure s quarters after a monetary policy shock. By varying the horizon h, we capture the different mechanisms contributing to changes in GaR. As shown in Section 2.2, changes in financial conditions are associated with short-term risks to GDP growth while macro-related variables contribute to medium-term risks. By observing the response of short-term GaR ($h = 4$) and medium-term GaR ($h = 8$) at different horizons s, we are able to construct impulse response functions without imposing rigid restrictions on the dynamic transmission of shocks. In doing so, we can also disentangle the role played by financial conditions and macroeconomic vulnerabilities, respectively, in explaining the response of GaR to monetary policy shocks.

In line with the literature, we construct monetary policy shocks by collecting high-frequency movements in asset prices around the ECB‘s monetary policy announcements (see, for instance, Gürkaynak *et al.* 2005). We use the dataset compiled by Altavilla *et al.* (2019) that records price and yield movements within a narrow window around the ECB‘s monetary policy announcements. Implicitly, the identification of these shocks relies on the assumption that, around and during these windows, no other news are affecting market rates. However, a branch of the literature on the identification of exogenous monetary policy shocks has highlighted that even these high-frequency movements in rates around central bank announcements might be polluted by news about the state of the economy that central bankers communicate to the public while explaining their monetary

policy decisions — the "information channel" (Nakamura and Steinsson 2018 and Miranda-Agrippino and Ricco 2021) of monetary policy announcements. To account for this, we remove the effect of the central bank information channel from the monetary policy shocks using sign restrictions.[9] This approach amounts to assuming that any positive (negative) reaction of the stock market after a contractionary (expansionary) monetary policy decision is a result of news about the state of the economy that the central bank communicates during the policy announcements rather than a reaction to the monetary policy decision itself, and therefore exclude the episodes in which such movements take place.

To capture the role of institutional quality in shaping the response of GaR to monetary policy shocks, we split our sample into two groups of countries based on their ranking in the World Bank's Worldwide Governance Indicators (WGI). The WGI are yearly indicators and capture public perceptions of the quality of governance over the period from 1996 to 2022 (see Kaufmann and Kraay 2023). The indicators are widely used in the literature as proxies for the overall quality of economic institutions (see, for instance, Acemoglu *et al.* 2014). Here, we use them for our panel of euro area countries from 1999 until 2019.

We construct a summary indicator based on the following WGI sub-indices, using equal weights: "government effectiveness", which evaluates the perception of quality of public services; "regulatory quality", which evaluates government quality in promoting and implementing laws that respect and promote private sector activity; "rule of law", which evaluates the confidence in police, courts, property rights, etc and the likelihood of crime and violence; and "control of corruption", which evaluates public perception on if public power is exercised for private gain, or captured by the interest of elites.[10] Overall, these four indicators, sometimes summarised as institutional delivery (Masuch *et al.* 2016), capture how well national institutions deliver a level playing field for all economic actors, prevent rents extraction and waste of resources and ensure sound economic incentives to invest, innovate and provide public goods. For each country, we then calculate the average value over the time period covered by our sample. Subsequently, we rank all euro area countries according to their average WGI score. Those in the top 25th percentile of the distribution across euro area countries are considered the best performers while those in bottom 25th percentile are the worst performers. The remaining countries with intermediate WGI scores are dropped from the sample. Our sample split ensures that our two groups of countries have significant differences in institutional quality.[11]

9. Specifically, we use the so-called "poor man's" sign restriction (see, for example, Jarociński and Karadi 2020, Buda *et al.* 2023).

10. We do not include the other available sub-indices "voice and accountability" and "political stability and absence of violence/terrorism" since they can be less directly influenced by policymakers.

11. Results are robust to slightly different choices of percentiles.

3.2. Results

We first estimate equation 2 in our full sample covering all 20 euro area countries in the period 1999Q1-2019Q4. Thereafter, we run the same regression separately for countries with weak and strong economic structures, respectively.

As illustrated by the full-sample results in Figures 3a and 3b, a contractionary monetary policy shock leads to more pronounced downside risks to GDP growth both in the short term ($h = 4$) and the medium term ($h = 8$). The impact on the short-run GaR is pronounced and persistent. On impact, GaR declines by around 1.25 percentage points. This negative effect vanishes only after six quarters. Turning to the IRF for the medium-term GaR measure, the increase in risks is also statistically and economically significant, albeit of smaller magnitude.

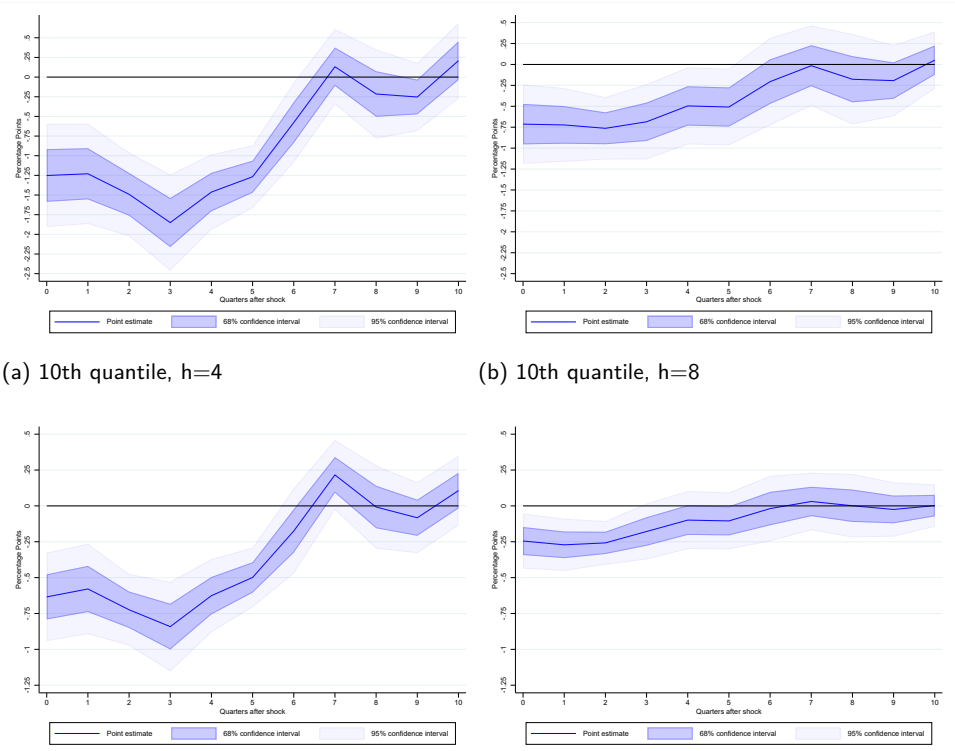
When we look at the interquantile range, defined as the difference between the lowest decile and the median of the predicted growth distribution, we obtain relatively similar IRFs (Figures 3c and 3d). Hence, a monetary policy shock not only shifts the predictive growth distribution to the left but importantly also moves probability mass to the left tail. In fact, the initial impact of a monetary policy shock on the 10th quantile exceeds that on the median by a factor of around 1.5. Again, the impact is more pronounced for $h = 4$ but still statistically and economically significant for $h = 8$. Taken together, these results indicate that monetary policy affects the distribution of future GDP growth asymmetrically. Our findings for the euro area are thus in line with those derived by Loria *et al.* (2024) for the United States.

Several data-generating processes are consistent with the tail risk asymmetry we find in the data. As noted by Loria *et al.* (2024), theoretical models featuring a financial accelerator mechanism or financial panics can explain why the impact of a contractionary monetary policy shock is more pronounced at the left tail of the GDP growth distribution.[12] In addition, our findings suggest that the amplification effect could be related to macroeconomic vulnerabilities. Indeed, the literature on the global financial crisis and sovereign debt crises shows that such vulnerabilities — including fiscal fragilities, excessive credit growth and current account imbalances — can magnify the impact of adverse economic shocks.[13] More concretely, such shocks can trigger a prolonged internal devaluation process coupled with demand compression, particularly in countries that are part of a monetary union.

Our empirical findings suggest that explanations for the tail risk asymmetry that are centered, respectively, on financial conditions and macroeconomic vulnerabilities could be complementary. As shown in Section 2, we find that financial conditions explain GaR in the short run while macroeconomic vulnerabilities play a more important role over the medium term. Since the fitted values from this regression enter our second-stage regression as a dependent variable, it follows

12. See, for example, Kiyotaki and Moore (1997) and Gertler *et al.* (2020).

13. See, for example, Lane and Milesi-Ferretti (2011) and Berkmen *et al.* (2012).



(a) 10th quantile, h=4

(b) 10th quantile, h=8

(c) Interquantile range, h=4

(d) Interquantile range, h=8

Figure 3: Impulse response functions of conditional GDP growth 4 and 8 quarters ahead (h=4, h=8) to a monetary policy shock

Notes: The darker (lighter) confidence intervals correspond to the 68% (90%) significance level. They are computed from heteroskedasticity-robust standard errors. The x-axis gives the horizon of the impulse response, in quarters. The monetary policy shock is normalised to 25 basis points. The first row presents the IRFs for the GaR estimates (i.e., the predicted 10th quantile) h quarters ahead as the dependent variable, while the second row presents the IRFs for the interquantile range (i.e., for the predicted 10th quantile minus the predicted median growth) as the dependent variable.

that the impact of a monetary policy shock on short-term risks will operate mostly through financial conditions whereas the effects on medium-term risk will mainly work through macroeconomic vulnerabilities.

We now turn to the role of institutional quality in shaping the response of GaR to monetary policy shocks in the euro area.[14] To this end, we split the sample into two country groups, namely those with the weakest scores in the World Bank's

14. For studies on the heterogeneous effects of monetary policy shocks across euro area countries, see also example Ciccarelli *et al.* (2013); Barigozzi *et al.* (2014); Slacalek *et al.* (2020); Corsetti *et al.* (2022)).

Worldwide Economic Governance Indicators and those with the strongest scores, as described above. Then we run regression 2 separately on these two sub-samples. We focus on medium-term GaR ($h = 8$), since this time horizon is particularly relevant for policymakers seeking to implement corrective policy action.

We find that contractionary monetary policy shocks tend to have a more pronounced impact on medium-term GaR in countries with weaker economic governance, as illustrated by Figure 4. The initial impact in these countries exceeds that in the best-performing euro area countries by about 0.6 percentage points. The initial impact on medium-term GaR in the countries with weak institutions is even of the same order of magnitude as the full-sample first-quarter impact for short-term GaR. Overall, our findings indicate that institutional quality interacts with macro-financial vulnerabilities, which are the main determinants of medium-term GaR (Section 2), in shaping the impact of monetary policy on downside risks to GDP growth over the medium term.

According to our empirical results, countries with institutional weaknesses seem to experience a more pronounced deterioration in macroeconomic vulnerabilities in the aftermath of a contractionary monetary policy shock. This, in turn, increases downside risks to growth over the medium term. To illustrate a possible mechanism at play, think about a country with weak public finances. Faced with tighter financing conditions, this country will – ceteris paribus – either need to engineer credible fiscal adjustment or achieve stronger long-term GDP growth to address concerns about debt sustainability. Both policy options may be harder to implement in countries with weak economic institutions, thus leading to a higher tail risk of severe output losses in the event of adverse shocks. However, this example is purely illustrative. Since our model framework limits our ability to pin down the mechanisms at play, we leave this line of work to future research.

Next, we explore if the cross-country heterogeneity in the IRFs is more pronounced when the monetary policy shock goes into a specific direction. To this end, we lift the assumption implicitly included in the analysis above whereby contractionary and expansionary monetary policy shocks have symmetric effects. This exercise is motivated by the literature emphasising non-linearities in the transmission of monetary policy shocks to economic activity. This literature overall presents strong evidence that contractionary monetary policy shocks have a stronger adverse impact on economic activity, while expansionary shocks have milder effects.[15]

15. The literature on the non-linear impacts of monetary policy has two main strands depending on whether the focus is on the state of the economy or the sign (or size) of the monetary policy shock. In this paper we focus on the different responses given the direction of the shock. The main finding of the key paper by Tenreyro and Thwaites (2016) is that, while monetary policy is less powerful during recessions, contractionary shocks are more powerful than expansionary ones. Barnichon and Matthes (2018), Lin (2020), Debortoli *et al.* (2023) and De Santis and Tornese (2024) find similar evidence.

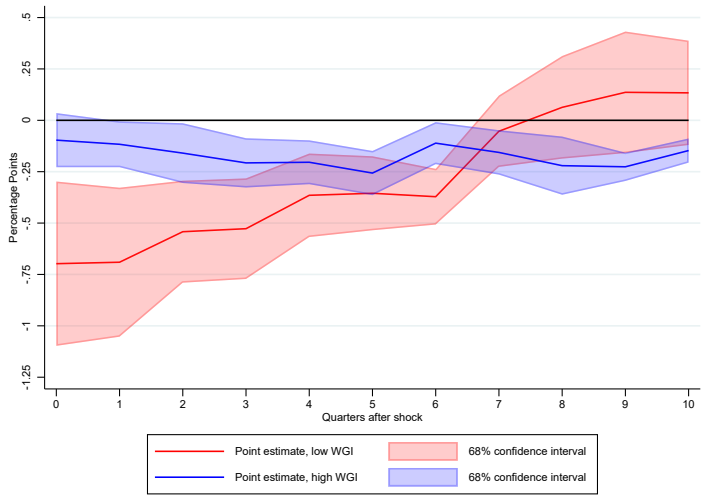


Figure 4: Impulse response function of conditional GDP growth 8 quarters ahead (h=8) to a monetary policy shock, low vs high WGI scores

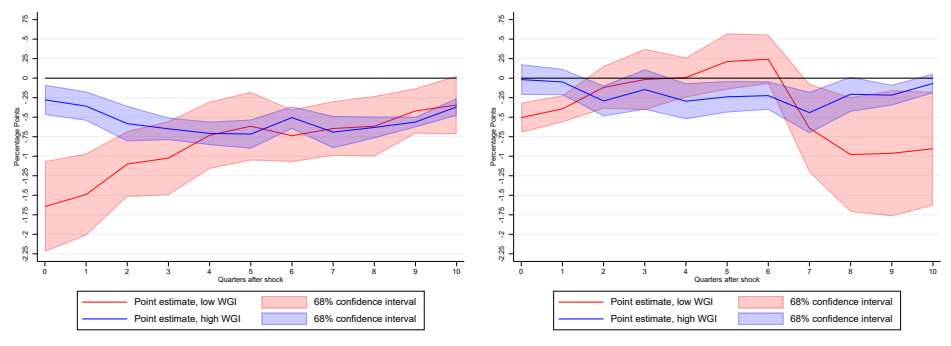
Notes: The confidence intervals correspond to the 68% significance level and are computed from heteroskedasticity-robust standard errors. The x-axis gives the horizon of the impulse response, in quarters. The monetary policy shock is normalised to 25 basis points. The IRF presented is for the interquantile range (i.e., for the predicted 10th quantile minus the predicted median growth) as the dependent variable.

Figure 5 investigates such non-linearities in the transmission of monetary policy shocks. It shows the IRFs for the two country groups, differentiating between contractionary and expansionary monetary policy shocks, respectively. For the sake of comparability, the IRFs for expansionary shocks are inverted.[16]

Our results suggest that contractionary monetary policy shocks significantly lower medium-term GaR for low-WGI countries and less so, at least initially, for high-WGI countries. By contrast, expansionary shocks have milder and less pronounced asymmetric effects. In other words, the heterogeneity highlighted in Figure 4 seems to be more pronounced when the policy shocks are contractionary rather than expansionary. The milder effects of expansionary monetary policy shocks are in line with Forni *et al.* (2024) who find that substantial monetary policy easing is needed to stabilise macroeconomic risk arising from credit markets.

Judging by our findings based on historical data, the monetary policy tightening implemented by the ECB between July 2022 and September 2023 might have contributed to a deterioration in macroeconomic vulnerabilities and ultimately increased downside risks to medium-term GDP growth in countries with weaker WGI scores. Monitoring macroeconomic vulnerabilities in euro area countries, in

16. Appendix A.5.4 shows the same IRFs but for the median responses.



(a) Contractionary shocks (b) Expansionary shocks

Figure 5: Impulse response functions of conditional GDP growth 8 quarters ahead (h=8) to contractionary and expansionary monetary policy shocks, low vs high WGI scores

Notes: For comparability, the IRFs for the expansionary shocks are inverted. The confidence intervals correspond to the 68% significance level and are computed from heteroskedasticity-robust standard errors. The x-axis gives the horizon of the impulse response, in quarters. Both types of monetary policy shocks are normalised to 25 basis points. The IRFs presented are for the interquantile range (i.e., of the predicted 10th quantile minus the predicted median growth) as the dependent variable.

addition to financial stress, is therefore essential for an early identification of risks to growth.

3.3. Assessing the transmission channels

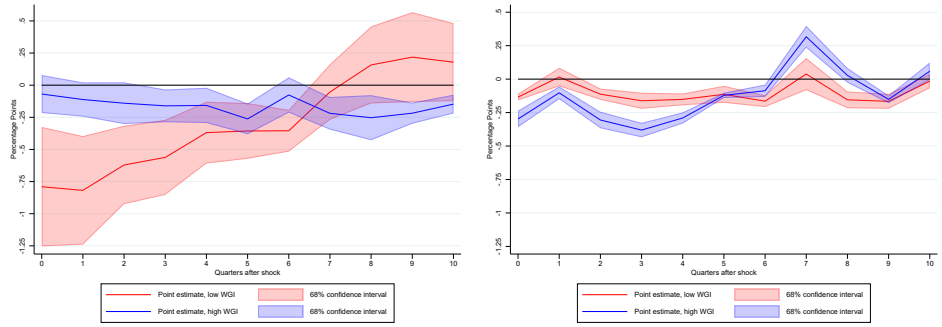
As shown above, the responses of GaR to monetary policy shocks operate through two different channels, depending on the GaR horizon considered. While the financial stress channel is the most relevant for short-term risks to growth, the macro-financial channel matters more for the longer time horizons and seems to be particularly important for countries with weaker WGI scores (Figure 4).

To test this proposition more formally, we re-assess the transmission of monetary policy shocks after shutting down some channels in the first-stage estimation of GaR. Specifically, we re-estimate regression 1 for $h = 8$ with the CLIFS coefficient set to zero.[17] Given our hypothesis that macro-financial variables rather than the financial stress channel explain most of the response of medium-term GaR to a monetary policy shock, excluding CLIFS from the first-stage regression and re-running the local projections exercise (regression 2) should deliver similar results to those in Figure 4. Shutting down all coefficients in regression 1 except the

17. Notice that, by setting this coefficient in the first-step regression 1 to zero, we are re-estimating the other set of coefficients and so re-estimating our conditional quantiles — the GaR measures that we pass to the second-step local projections as the dependent variable. Again, Loria *et al.* (2024) conduct a similar exercise in their setting.

one associated with CLIFS, in turn, should lead to materially different impulse responses. In this case, we are forcing the financial stress channel to be the only transmission mechanism from monetary policy shocks to medium-term GaR — in contrast to what was previously documented.

Figure 6 inspects these mechanisms. Figure 6a resembles Figure 4, thus reinforcing the view that the macro-financial channel is decisive in creating more instabilities in low-WGI countries in response to monetary policy shocks. Figure 6b shows how medium-term risks to growth respond to a monetary policy shock when we restrict transmission to the financial stress channel. In this case, we find only small differences in the IRFs of low and high WGI countries. The results are thus consistent with our reading of the data.



(a) Only macro-financial variables in first stage (b) Only CLIFS in first stage

Figure 6: Impulse response functions of conditional GDP growth 8 quarters ahead (h=8) to a monetary policy shock, with the CLIFS coefficient set to zero, low vs high WGI scores

Notes: The confidence intervals correspond to the 68% significance level and are computed from heteroskedasticity-robust standard errors. The x-axis gives the horizon of the impulse response, in quarters. The monetary policy shock is normalised to 25 basis points. The IRF presented is for the interquantile range, i.e. for the predicted 10th quantile minus the predicted median growth, as the dependent variable.

4. Robustness exercises

In this section, we summarise different robustness checks. Overall, our econometric results are robust to (i) using different indicators capturing medium-term risks to GDP growth when estimating GaR, (ii) replacing the WGI with an alternative measure of institutional quality, (iii) accounting for cross-country differences in income levels and (iv) altering either the countries or the time period covered in our sample.

Using an alternative macro-financial vulnerability indicator. The Systemic Risk Indicator (SRI), introduced by Lang *et al.* (2019), is an indicator with

significant predictive power for large declines in real GDP three to four years in advance for euro area countries. As Lang *et al.* (2023) show, this vulnerability indicator contains information about GaR in the medium term. It is thus a natural candidate to be considered as an alternative explanatory variable to capture the macro-financial vulnerabilities channel. In this robustness exercise, we replace credit growth, housing price growth and the current account in the first-stage estimation (equation 1) with the SRI.[18] In Appendix A.5.1, we show that the IRFs from this robustness exercise deliver the same conclusions as our baseline exercise.

Changing the measure of institutional quality. In this exercise, we replace the WGI score with the World Competitiveness Ranking scores by the International Institute for Management Development (IMD) (IMD 2022). The IMD *"uses statistical indicators and survey-based evidence to rank countries according to how they manage their competencies to achieve long-term value creation"*. In practice, the IMD measure captures the extent to which countries' infrastructures, policy decisions and institutions promote innovation and economic growth. Using this indicator instead of WGI data provides very similar results to our baseline estimates, as shown in Appendix A.5.2.

Accounting for cross-country differences in income levels. We also perform a robustness check in which we orthogonalise the WGI scores to GNI per capita in each country before ranking the countries. This exercise aims to capture the component of institutional quality that is not explained by the level of income. It thus addresses the possibility that our results might be driven by a strong correlation between institutional quality and income. We show the IRFs, which corroborate our main findings, in Appendix A.5.3.[19]

Accounting for the global financial crisis and the COVID-19 pandemic. Our main results are also robust to changes in the time period covered in our sample. We first test to which extent the coefficients in the first-stage regression are affected by the Global Financial Crisis (GFC). As shown in Appendix A.4.1, controlling directly for this period absorbs the short-run impact of CLIFS on GaR, rendering it statistically insignificant.[20] However, the other macro-financial variables remain significant for medium- and longer-term GaR.

Including the COVID-19 period could distort the results as it featured considerable output declines in virtually every country in the sample which were not associated with or anticipated by any financial stress or macro-financial variable in the years before. However, in Appendix A.4.2 we show that the conclusions from

18. As noted by Lang *et al.* (2023), the SRI "*captures risks stemming from domestic credit, real estate markets, asset prices, and external imbalances*".

19. To further strengthen the argument that it is institutional quality and not income levels driving our results, we have run an additional robustness exercise in which we rank the countries according to their average income levels – rather than their WGI scores – over the sample period. The IRFs obtained are materially different from the ones presented in Figure 4.

20. We control for the GFC period by adding a dummy variable to the regression that takes the value of one during 2008 and 2009.

the first-stage regression remain practically unchanged even when we extend our sample until the end of 2022 and thereby include the pandemic period in the GaR estimation.

Excluding financial centres and late euro adopters. Our main findings are also insensitive to the exclusion of specific countries from the sample. Specifically, in Appendices A.4.3 and A.4.4 we show that the results are robust to excluding countries that might be considered financial centres[21] or that joined the monetary union later than the founding members[22], respectively. Although excluding financial centres from the sample reduces the short-run explanatory power of CLIFS, the macro-financial variables maintain practically the same coefficients for the medium- and long-term GaR horizons.

5. Conclusion

In this paper, we show that cross-country differences in economic institutions contribute to the heterogeneous transmission of monetary policy shocks in the euro area. We also document that this effect is asymmetric in that it is more pronounced for contractionary than for expansionary shocks. More specifically, we find that contractionary monetary policy shocks have a particularly large impact on medium-term GaR in euro area countries with relatively low institutional quality.

Of course, there are various sources of heterogeneity in monetary policy transmission in addition to institutional quality (Bundesbank 2023). As demonstrated by the global financial crisis and the subsequent sovereign debt crisis, they can have important implications for tail risks in the euro area economy. At the time, severe disruptions in money markets and sovereign bond markets – coupled with re-denomination risk – prevented a uniform transmission of monetary policy in the euro area. The ECB responded to these transmission obstacles by implementing a broad range of non-standard monetary policy tools.[23]

Our empirical findings suggest that (upward) institutional convergence in the euro area – implemented via targeted structural reforms – would enhance the uniform transmission of monetary policy and reduce tail risks. Insofar, our findings are consistent with a growing literature suggesting that convergence *before* euro adoption, as captured by the so-called 'Maastricht criteria', needs to be complemented by continuous convergence *after* euro adoption.[24] We contribute to this literature by emphasising the crucial role structural policies can play in enhancing economic resilience and the smooth transmission of monetary policy.

21. This robustness check excludes from the sample Cyprus, Ireland, Luxembourg and Malta.

22. The first 12 countries having adopted the euro in 2002 were Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain.

23. See, for instance, Ciccarelli *et al.* (2014); Hartmann and Smets (2018); Rostagno *et al.* (2019).

24. See, for instance, Diaz del Hoyo *et al.* (2017); Fernández-Villaverde *et al.* (2013).

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Appendix: Appendix

A.1. Distribution of unconditional GDP growth

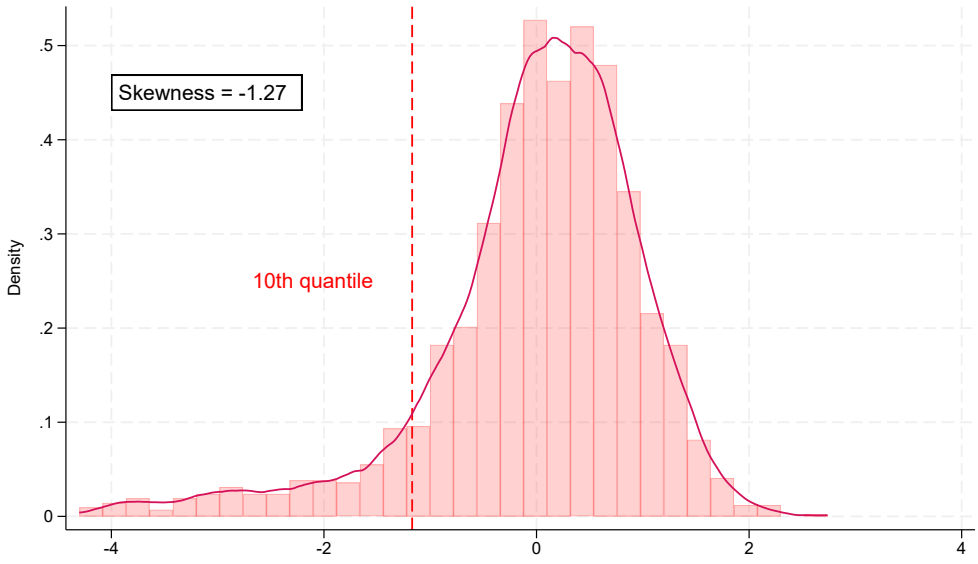


Figure A.1: Histogramme of unconditional GDP growth

Notes: The plotted histogramme presents the standardised GDP growth rates for euro area countries between 1995Q1 and 2019Q4.

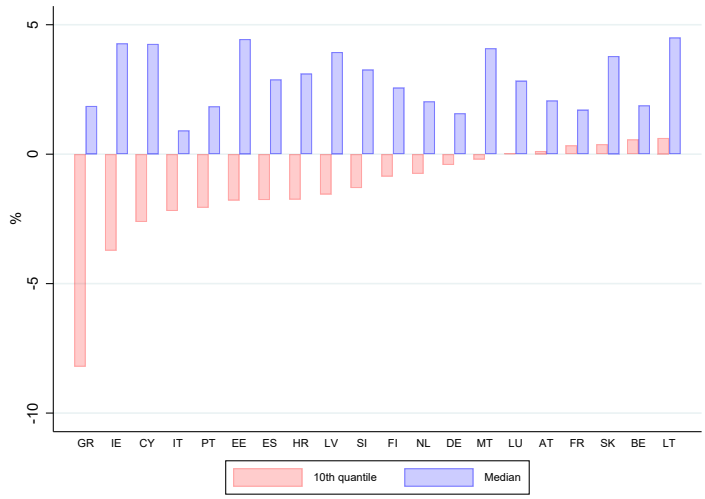


Figure A.2: Unconditional 10th percentile and median GDP growth

Notes: The figure shows the 10th percentile and the median of the unconditional distribution of annualised average real GDP growth in individual euro area countries in a sample covering the period from 1995Q1 to 2019Q4.

A.2. Different percentiles of the distribution of conditional future GDP growth

Table A1 illustrates the coefficients for different percentiles of the GDP growth distribution. In particular, the coefficient estimates on the credit-to-GDP gap differ significantly for the lower 10th percentile of the growth distribution compared to the median and the 90th percentile. While the coefficients are strongly negative for the 10th percentile (both for two and three years ahead projections), they increase for the median and even turn positive for the 90th percentile (in the 2-year ahead specification). In contrast, the effects of CLIFS are generally negative, suggesting that this stress indicator shifts the entire conditional distribution of future growth to the left and not only the left tail.

The remaining variables have a similar pattern for the 10th percentile, the median and the 90th percentile of predicted GDP growth, despite some discernible quantitative differences. In particular, high budget deficits and high current account deficits have a stronger impact on the 10th percentile than on the median and the 90th percentile, indicating that the effects of these variables on GDP growth also vary over time and across the quantiles.

	10th percentile		Median		90th percentile	
	h=8	h=12	h=8	h=12	h=8	h=12
CLIFS	-0.331	-0.176*	-0.267**	-0.185***	-0.220*	-0.192***
	(0.429)	(0.136)	(0.148)	(0.061)	(0.138)	(0.098)
GDP	0.049	-0.004	0.011	0.017	-0.017	0.033
	(0.195)	(0.054)	(0.067)	(0.024)	(0.063)	(0.039)
Credit-to-GDP Gap	-0.525*	-0.435***	-0.163	-0.215***	0.109	-0.053
	(0.497)	(0.164)	(0.172)	(0.074)	(0.160)	(0.117)
House Prices	-0.039	-0.031***	-0.011	-0.014***	0.010	-0.001
	(0.050)	(0.015)	(0.017)	(0.007)	(0.016)	(0.011)
Budget Balance	0.438**	0.314***	0.314***	0.227***	0.222***	0.163***
	(0.262)	(0.088)	(0.091)	(0.039)	(0.084)	(0.063)
Current Account	0.228*	0.247***	0.155***	0.184***	0.100***	0.138***
	(0.142)	(0.048)	(0.049)	(0.022)	(0.046)	(0.034)
Observations	1103	1027	1103	1027	1103	1027

Table A1. Coefficients for different percentiles, h=8 and h=12 quarters ahead

Notes: Quantile regression with country fixed effects and controlling for when the country adopted the euro. Standard errors in parentheses. Stars indicate significance at * p<0.32, ** p<0.10, *** p<0.05.

A.3. Cross-country averages for shorter- and longer-term GaR

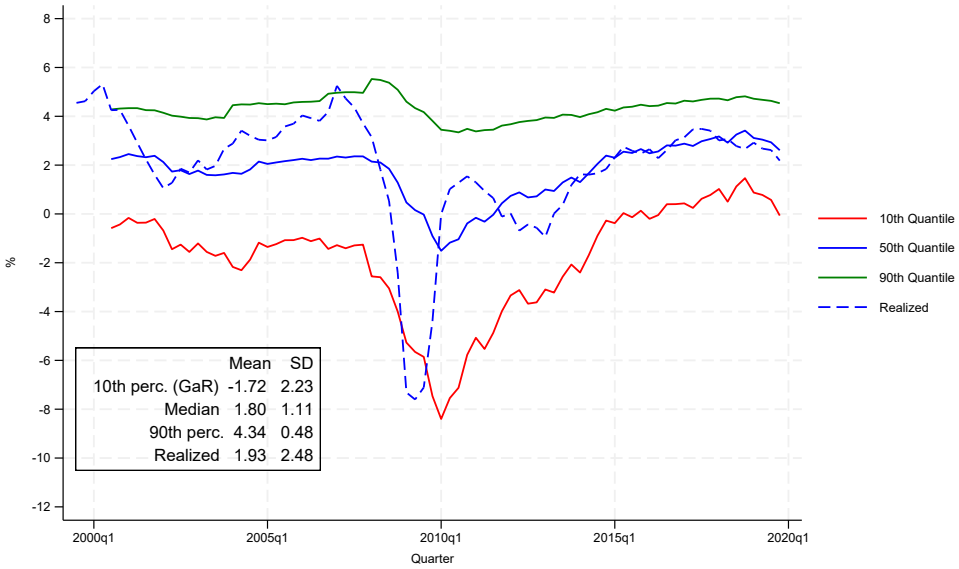


Figure A.3: Predicted 10th (GaR), median and 90th percentiles of 4-quarter ahead GDP growth and realised GDP growth

Notes: The plotted predicted 4-quarter ahead 10th, median, and 90th percentiles of the annualised average growth rate of GDP are the cross-country averages of each country prediction (obtained using model 1). These series are shifted forward by 4 quarters such that the timing of the predicted growth rate and the realised one match.

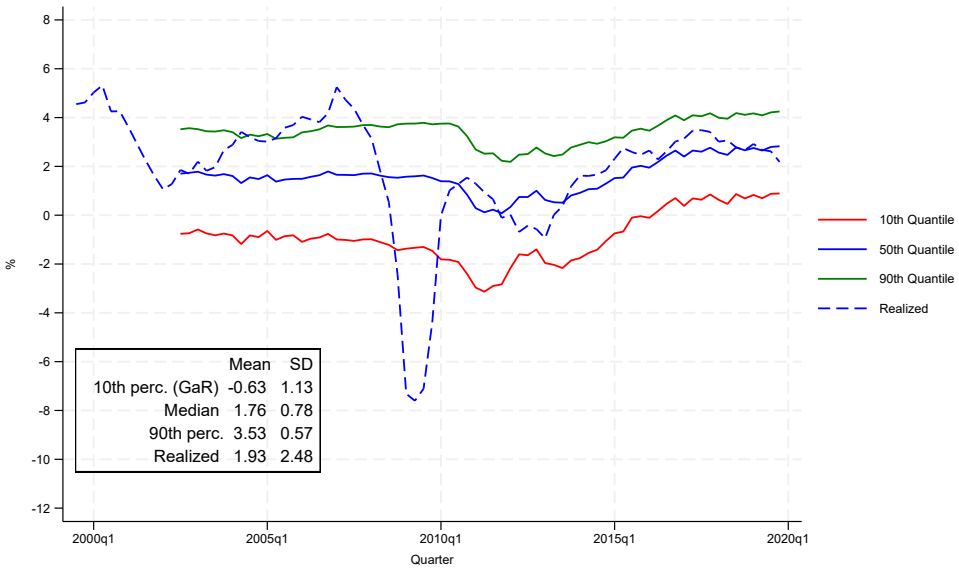


Figure A.4: Predicted 10th (GaR), median and 90th percentiles of 12-quarter ahead GDP growth and realised GDP growth

Notes: The plotted predicted 12-quarter ahead 10th, median and 90th percentiles of the annualised average growth rate of GDP are the cross-country averages of each country prediction (obtained using model 1). These series are shifted forward by 12 quarters such that the timing of the predicted growth rate and the realised one match.

A.4. Robustness checks to GaR estimates

	h=4	h=8	h=12
CLIFS	-0.241	-0.221	-0.148*
	(0.507)	(0.244)	(0.128)
GDP	0.076	-0.016	-0.043
	(0.250)	(0.115)	(0.054)
Credit-to-GDP Gap	-0.313	-0.526***	-0.437***
	(0.423)	(0.262)	(0.147)
House Prices	0.006	-0.030*	-0.028***
	(0.046)	(0.028)	(0.014)
Budget Balance	0.330*	0.400***	0.265***
	(0.211)	(0.134)	(0.072)
Current Account	0.197**	0.205***	0.217***
	(0.120)	(0.074)	(0.042)
GFC	-7.288***	-2.060***	-1.151***
	(2.225)	(0.997)	(0.462)
Observations	1179	1103	1027

Table A2. Quantile regression coefficients for different horizons of GaR, controlling for the GFC period

Notes: Quantile regression with country fixed effects and controlling for when the country adopted the euro. GaR refers to the 10th percentile of predicted GDP growth. Standard errors in parentheses. Stars indicate significance at * p<0.32, ** p<0.10, *** p<0.05.

A.4.1. The role of the global financial crisis (GFC).

	h=4	h=8	h=12
CLIFS	-0.832***	-0.364**	-0.200*
	(0.339)	(0.211)	(0.138)
GDP	0.312***	0.043	-0.008
	(0.155)	(0.093)	(0.053)
Credit-to-GDP Gap	-0.309	-0.600***	-0.482***
	(0.339)	(0.260)	(0.175)
House Prices	-0.040*	-0.039*	-0.031***
	(0.035)	(0.024)	(0.015)
Budget Balance	0.438***	0.437***	0.311***
	(0.170)	(0.125)	(0.086)
Current Account	0.274***	0.222***	0.239***
	(0.091)	(0.068)	(0.047)
Observations	1179	1103	1027

Table A3. Quantile regression coefficients for different horizons of GaR, including the Covid-19 period

Notes: Quantile regression with country fixed effects and controlling for when the country adopted the euro. GaR refers to the 10th percentile of predicted GDP growth. Standard errors in parentheses. Stars indicate significance at * $p<0.32$, ** $p<0.10$, *** $p<0.05$.

A.4.2. Including the COVID-19 period.

	h=4	h=8	h=12
CLIFS	-0.315*	0.036	0.055
	(0.302)	(0.492)	(0.113)
GDP	0.288**	-0.029	-0.031
	(0.161)	(0.250)	(0.050)
Credit-to-GDP Gap	-0.090	-0.263	-0.278**
	(0.290)	(0.599)	(0.157)
House Prices	-0.018	-0.017	-0.031**
	(0.038)	(0.071)	(0.016)
Budget Balance	0.473***	0.500**	0.420***
	(0.165)	(0.291)	(0.068)
Current Account	0.394***	0.309*	0.205***
	(0.108)	(0.206)	(0.052)
Observations	960	900	840

Table A4. Quantile regression coefficients for different horizons of GaR, excluding financial centres from the sample

Notes: Quantile regression with country fixed effects and controlling for when the country adopted the euro. GaR refers to the 10th percentile of predicted GDP growth. Standard errors in parentheses. Stars indicate significance at * p<0.32, ** p<0.10, *** p<0.05. This exercise excludes from the sample Cyprus, Ireland, Luxembourg and Malta.

A.4.3. Excluding financial centres.

	h=4	h=8	h=12
CLIFS	-0.836***	-0.306*	-0.122
	(0.247)	(0.217)	(0.207)
GDP	0.152*	0.008	-0.057
	(0.129)	(0.128)	(0.118)
Credit-to-GDP Gap	-0.233*	-0.441**	-0.299*
	(0.201)	(0.231)	(0.217)
House Prices	0.024*	0.003	-0.005
	(0.022)	(0.027)	(0.028)
Budget Balance	0.248***	0.306***	0.222**
	(0.113)	(0.134)	(0.128)
Current Account	0.160***	0.190***	0.292***
	(0.064)	(0.084)	(0.077)
Observations	810	762	714

Table A5. Quantile regression coefficients for different horizons of GaR, only for the 12 early euro adopters

Notes: Quantile regression with country fixed effects. GaR refers to the 10th percentile of predicted GDP growth. Standard errors in parentheses. Stars indicate significance at * $p<0.32$, ** $p<0.10$, *** $p<0.05$. This exercise includes Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain.

A.4.4. Early euro adopters.

A.5. Different IRFs

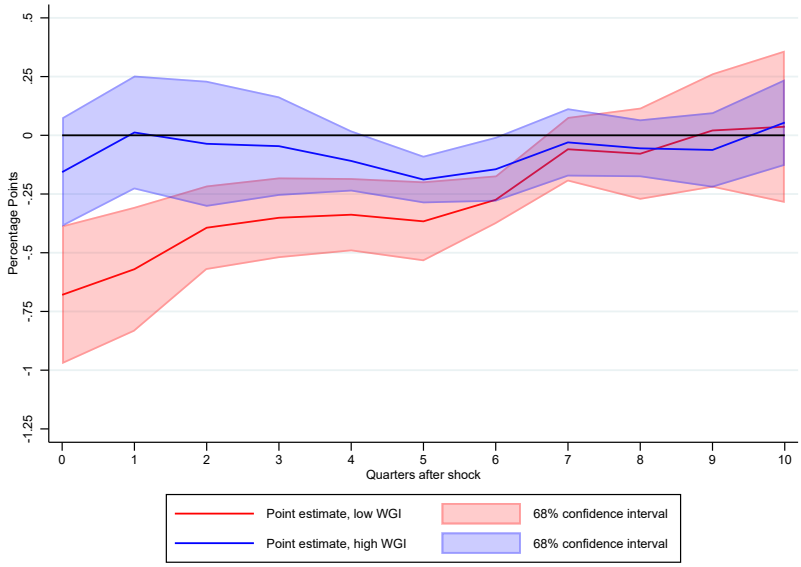


Figure A.5: Impulse response functions of the conditional GDP growth 8 quarters ahead (h=8), low vs high WGI, using SRI in first stage estimation

Notes: The confidence intervals correspond to the 68% significance level and are computed from heteroskedasticity-robust standard errors. The x-axis gives the horizon of the impulse response, in quarters. The monetary policy shock is normalised to 25 basis points. The IRF presented is for the interquantile range (i.e., for the predicted 10th quantile minus the predicted median growth) as the dependent variable.

A.5.1. IRFs using SRI in first-stage GaR estimation.

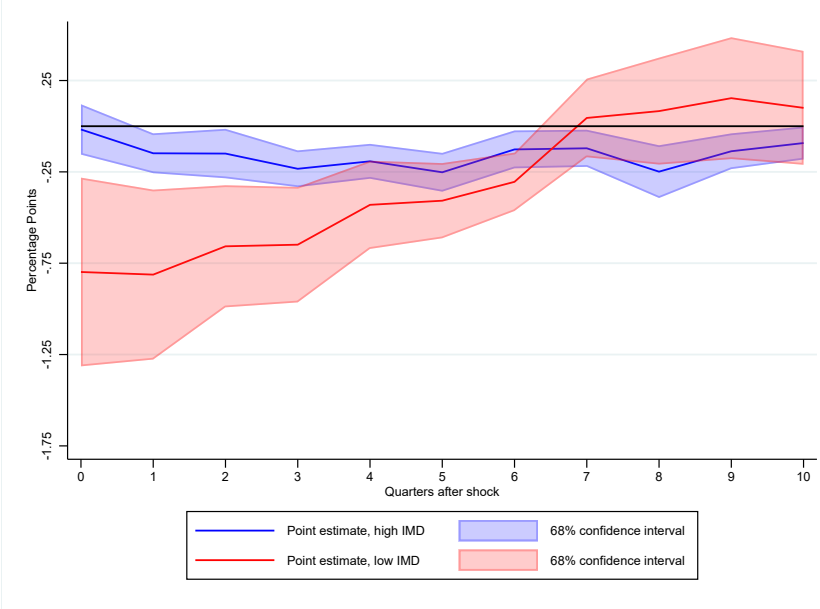


Figure A.6: Impulse response functions of the conditional GDP growth 8 quarters ahead (h=8), low vs high IMD ranking positions

Notes: The confidence intervals correspond to the 68% significance level and are computed from heteroskedasticity-robust standard errors. The x-axis gives the horizon of the impulse response, in quarters. The monetary policy shock is normalised to 25 basis points. The IRF presented is for the interquantile range (i.e., for the predicted 10th quantile minus the predicted median growth) as the dependent variable.

A.5.2. IRFs with IMD as institutional indicator.

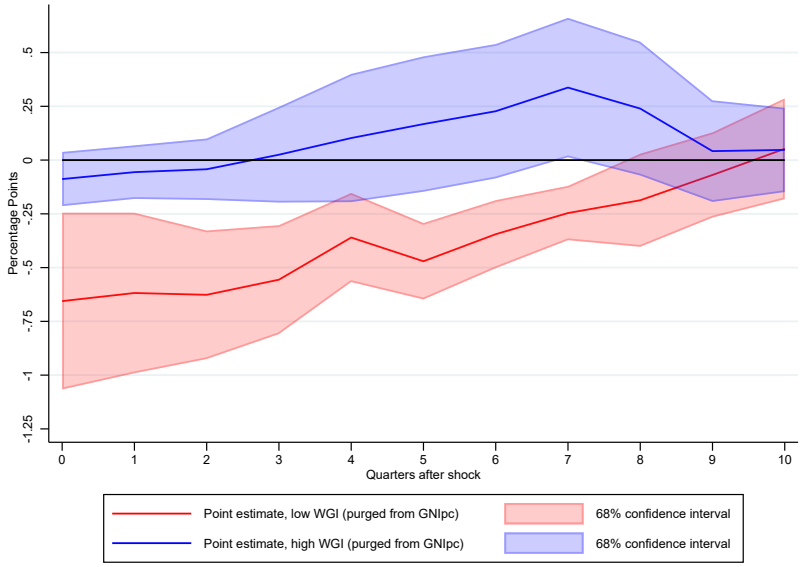
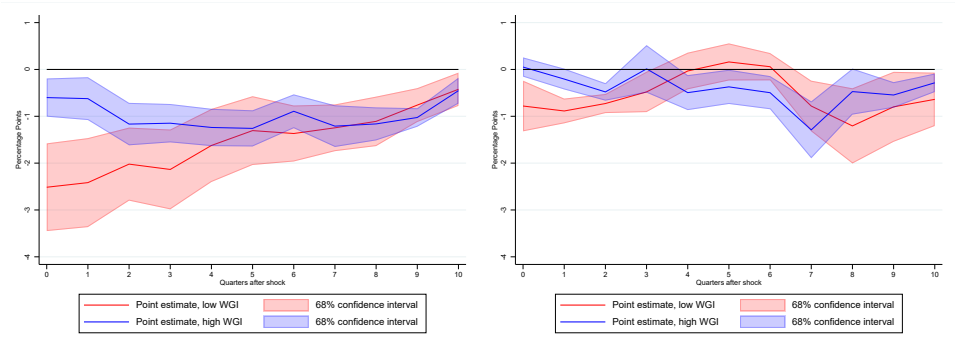


Figure A.7: Impulse response functions of the conditional GDP growth 8 quarters ahead (h=8), low vs high WGI, considering only the WGI component orthogonal to GNI per capita

Notes: The confidence intervals correspond to the 68% significance level and are computed from heteroskedasticity-robust standard errors. The x-axis gives the horizon of the impulse response, in quarters. The monetary policy shock is normalised to 25 basis points. The IRF presented is for the interquantile range (i.e., for the predicted 10th quantile minus the predicted median growth) as the dependent variable. To obtain the WGI component that is orthogonal to income levels, we first regress the level of WGI on the level of GNI per capita in our sample period (including country and year fixed effects) and then use the residuals of that regression as our cleaned measure of institutional quality.

A.5.3. IRFs with income level effects purged from WGI.



(a) Contractionary shocks (b) Expansionary shocks

Figure A.8: Impulse response functions of the median conditional GDP growth 8 quarters ahead (h=8) to contractionary and expansionary monetary policy shocks, low vs high WGI scores

Notes: For comparison, the IRFs for the expansionary shocks are inverted. The confidence intervals correspond to the 68% significance level and are computed from heteroskedasticity-robust standard errors. The x-axis gives the horizon of the impulse response, in quarters. The monetary policy shock is normalised to 25 basis points. The IRFs are for the predicted median growth as the dependent variable.

A.5.4. IRFs of median predicted GDP to contractionary and expansionary monetary policy shocks.

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